A maturity model for demand-driven supply chains in the consumer product goods industry

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ABSTRACT

The paper presents a theoretical framework to assist companies to assess their current stage of maturity for a demand-driven supply chain and to develop strategies to progress towards higher maturity levels. It reviews the dimensions and stages of the maturity model, as well as the main concepts of demand-driven supply chains. A participatory consensus building approach to maturity model development was applied to three countries of an international beverage company: Brazil, the United States, and Uruguay. Teams of Supply Chain (SC) executives applied the Analytical Hierarchy Process (AHP) to assign priorities and rank the actual and desired dimensions of maturity for their own SC. The teams were able to analyse their results and deploy strategies to improve their processes towards becoming a demand-driven company, taking into consideration their competitive environment and market position. All SC currently deployed push-based strategies and are in the early stages of maturity to become demand-driven SC.

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1. Introduction

Companies competing in today's retail marketplace face competing demands to launch innovative products and improve customer service levels while keeping out-of-stock (OOS) products low and reduced supply chain (SC) costs. The deleterious effects of OOS in profits and market share in retail chains are amply documented in the literature, through mathematical modelling (Avlijas et al., 2015), comparison of experiments (Jain et al., 2015), case study (Madhani, 2015) and survey research (Gruen and Korsten, 2007). Despite, OOS in retail chains remains persistently at a high 8% worldwide (Gruen and Korsten, 2007). Forecast errors for radically new products situate at a high 44–53% and average 31% for improved products (Kahn, 2002; Jain, 2007). Low forecast accuracy coupled with high variability in demand prompt companies often to compensate with expensive operational remedies such as transhipment between distribution centres at expedite transportation costs, therefore maintaining high service levels at the expenses of shrinking profit margins (Simchi-Levi et al., 2003). Balancing inventory and transportation costs is at the heart of inventory routing research (Coelho et al., 2014). Inventory inaccuracy contributes to amplify these harmful effects (Cannella

et al., 2015), as exemplified in a three-tiers SC by Fleisch and Tellkamp (2005), among others. Even small losses in inventory accuracy might result in large stock-outs (Kang and Gershwin, 2005; Thiel et al., 2010). Customers facing OOS products tend to switch package size, product item, purchase store, or even to postpone or cancel purchases altogether (Campo et al., 2000). To manage the volatility in demand effectively, companies in different industries (e.g. personal computers, meat, fashion) have adopted demand-driven supply chains (DDSC) (Christopher and Towill, 2001; Canever et al., 2008; Caro and Gallien, 2010). The automotive industry has equally made significant efforts to become demand-driven (e.g., Holweg, 2005; Holweg and Pilb, 2008). DDSC are broader than Supply Chain Management (SCM) as it emphasizes customer demand, as well as product and service deployment to meet costumers' needs (Canever et al., 2008; Lun et al., 2013). DDSC are customer activated pull systems (Hull, 2005) that move market strategies from make-to-stock to make-to-order and hybrid push-pull systems (Christopher and Towill, 2001; Ayers and Malmberg, 2002; Harrison, 2003). It is a contention of this study that companies pass through successive maturity stages to becoming demand-driven. The concept of maturity models (MM) assumes that there are successive stages in the lifecycle of a process and that these stages indicate how explicitly the process is defined, managed, measured and controlled (Paulk et al., 1993; Lockamy and McCormack, 2004). A DDSC maturity model (DDSC-MM) is proposed and tested in a large multinational beverage

company at regional and national levels in three countries at different SC maturity stages: Brazil, the United Sates, and Uruguay. The paper adds an original angle to the extant literature in SC-MM (García-Mireles et al., 2012; Plomp and Batenburg, 2010; Estampe et al., 2013) in four ways. First, it develops a participatory MM for DDSC using a novel process, based on the application of the multi-criteria Analytic Hierarchy Process (AHP) method (Saaty, 1980). Second, it tests the MM in three countries. Third, it focuses specifically on consumer product goods industry in a large beverage company. Fourth, it shows how the DDSC-MM can be applied to SC strategy deployment.

The structure of the paper is as follows. Section 2 elaborates on the theoretical background of DDSC concept and presents an integrated framework for DDSC deployment. Section 3 describes the methodology for the DDSC-MM development and application. Section 4 introduces the DDSC-MM. Section 5 is a presentation of results and discussions. Concluding remarks with indications for future research and practice close the paper.

2. Theoretical background

This section is subdivided in demand-driven supply chains' background and maturity models for supply chain management.

2.1. Demand-driven supply chain

The APICS Dictionary defines Supply Chain Management as "the design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand, and measuring performance globally" (Blackstone, 2013, p. 172). Providing products that match supply with demand is a central concept in DDSC. Friscia et al. (2009) define a demand-driven supply network as a system of technologies and business processes that sense and respond to demand signals in real time, through a network of customers, suppliers, and employees. Emmett and Crocker (2006) argues that while supply chain connotes the idea of "pushing" goods and services through a network, the term "demand chain" could be more

appropriate, and a combination of supply and demand concepts could be better expressed in the designation of a DDSC.

For Ayers and Malmberg (2002), a company strives to be demand-driven when it shifts from a "build to forecast" to a "build to order" strategy, on a continuum from being zero to 100% demand-driven, from production/inventory decisions that are entirely forecast-based (e.g., fashion, beverage industries) to a situation in which orders are received prior to production (e.g., aeronautics). Similarly, Bowersox and Lahowchich (2008) emphasize that in traditional SC, volume and product forecast anticipated to meet demand is "pushed" to local markets, often resulting in high OOS and wrong inventories being "pushed" to wrong markets. As exemplified by Mendes (2011) and shown in Fig. 1 for a Brazilian beverage company, this dysfunctional distribution system is aggravated by imbalances generated by promotions and end-of-month sales designed to entice consumers to buy excess inventories. The promotion of families of products in the beverage industry is also a common selling strategy in the soft drink market in the UK (Ramanathan and Muyldermans, 2010).

The distribution peaks portrayed in Fig. 1 are opposed to what could be expected in a demand-driven flow, which is by definition a pull system initiated by an order from the customer to the retailer. The retailer triggers an order to the wholesaler, who reorder to the manufacturer, who in turn reorder to the suppliers of raw materials (Hull, 2005). Pull systems were defined at the strategic and tactical level by Hopp and Spearman (2003). In the former, customers dictate the takt time (or pace) of production, which is the "heartbeat of any lean production system" (Blackstone, 2013). In the later, the amount of work-in-process (WIP) that can be introduced into the production system is explicitly limited by demand. In contrast, there are no limitations other than capacity restrictions to WIP in push systems.

This definition accommodates different types of pull systems, contingent upon the limits imposed on WIP. Ashayeri and Kampstra (2005) provide the following definitions of push-pull systems variations. In a push system, order planning and information flow from the preceding to the succeeding node. It is in contrast with a semi push or push-pull system, in which succeeding nodes make requests fulfilled by a preceding node, which replenishes pulling from stock that rebuild periodically. In a pure pull system,
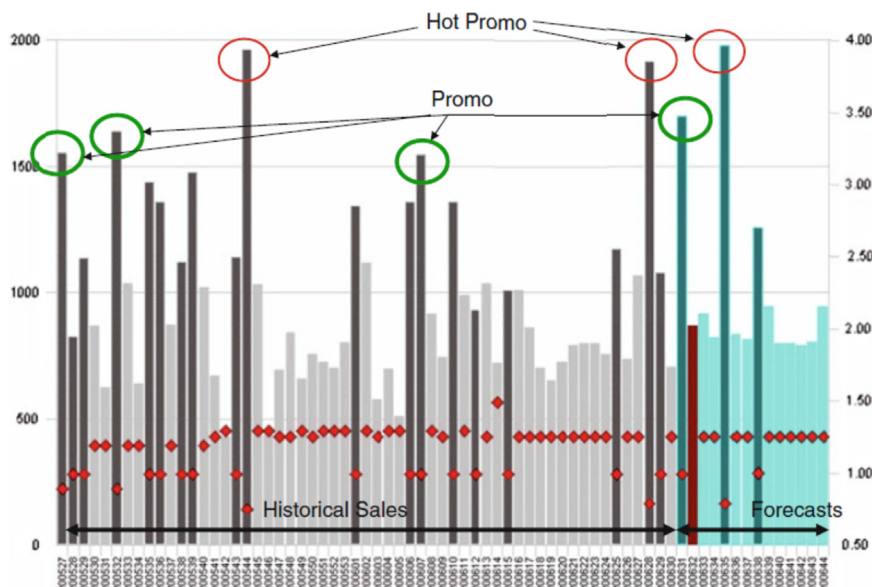

Fig. 1. Weekly Sales Volume of Brazilian Beverage Company (Mendes, 2011).